

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

BIOLOGICAL EVALUATIONS OF SPRUCE BUDWORM INFESTATIONS IN 1965

on the

BOISE, BRIDGER, CHALLIS, FISHLAKE, PAYETTE, SALMON, SAWTOOTH, AND TARGHEE
NATIONAL FORESTS in IDAHO, WYOMING, and UTAH

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(Excerpts from reports on forest insect conditions on the above-named National Forests during 1965)



U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
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BOISE NATIONAL FOREST, 1965

Spruce budworm infestations in Douglas-fir and true firs were observed in the Wilderness Area of the Boise National Forest in 1965. Aerial observations of the infestation showed that light and moderate damage classes were almost nonexistent. Heavy defoliation occurred on 60,200 acres. This infestation has been persistent for several years and is contiguous with budworm infestations on the Payette and Challis National Forests. At the present time budworm populations extend up main Marble Creek and its numerous side drainages; then in a somewhat eastward, northeastward line, down the Middle Fork of the Salmon River and in a northward direction to the Payette-Boise boundary. Due to the Chief's policy of giving infestations relatively low priority for evaluation work in wilderness areas, on-the-ground evaluations were not made of the infestation in 1965.

During this year's flights it was observed that some tree mortality is occurring throughout the understory in reproduction and pole-size Douglas-fir. Scattered killing of trees takes on a mosaic pattern throughout the infested area. Tree mortality of this type has been noted throughout the entire infested area on the Boise; however, it is not extensive in nature.

BRIDGER NATIONAL FOREST, 1965

Approximately 10,000 acres of subalpine and Douglas-fir were defoliated by the spruce budworm between Bailey and West Bailey Creeks and in Porcupine Creek, Greys River Drainage. Overall defoliation in both areas was classed as light.

Sequential samples of Douglas-fir foliage taken from the infestations in Bailey and West Bailey Creeks indicated that defoliation of 1965 growth was less than 25 percent. Egg mass density averaged 12.27 per thousand square inches of foliage. On this basis, defoliation of new growth in these areas next year is expected to average between 51-90 percent.

In Porcupine Creek, defoliation of 1965 growth was less than 25 percent and egg mass density averaged 3.7 per thousand square inches of foliage. Defoliation of new growth next year is expected to average between 15-25 percent.

In order to avoid possible misunderstanding, it should be mentioned that these defoliation estimates are based only on the percentage of new buds and needles attacked. Overall defoliation may be less than ten percent, even though fifty percent of the new foliage has been removed.

Spruce budworm populations have not reached epidemic proportions, and it is doubtful whether they will in the near future. Overall damage is light and confined mainly to subalpine fir. Some movement into budworm-free areas can be expected next year, but intensity of damage should remain light. No trees are under stress, nor are any expected to receive greater damage in 1966.

CHALLIS NATIONAL FOREST, 1965

No significant decrease in the overall extent of the spruce budworm infestation on the Challis National Forest was noted this year. The Challis infestation is actually a part of the huge Salmon River infestation which also covers much of the Salmon and portions of the Payette and Boise National Forests. A summary of infested acreage on the forest this year and last, as determined by aerial surveys, follows:

| <u>INFESTATION INTENSITY</u> | | | | |
|------------------------------|--------------|---------------|--------------|--------------|
| <u>YEAR</u> | <u>LIGHT</u> | <u>MEDIUM</u> | <u>HEAVY</u> | <u>TOTAL</u> |
| 1964 | 79,000 | 132,000 | 243,000 | 454,000 |
| 1965 | 83,200 | 20,500 | 297,600 | 401,300 |

Most of the infested acreage received heavy defoliation with the only significant change in defoliation intensity from 1964 to 1965 occurring in the medium category. Overall, the infestation boundaries changed very little in 1965. Relatively small areas of visible defoliation were found for the first time this year in Slate Creek and Woods Basin in the Salmon River Division and in ~~Ramshorn~~ Canyon and on the northeast side of Lone Pine peak in the Lost River Division.

Biological evaluation efforts were increased this year over previous years. Egg mass samples were taken from five areas on the forest, one in Morse Creek and four in major drainages within the infested area west of Challis. No on-the-ground evaluations were made in Loon and Spring Creeks nor in the Middle Fork of the Salmon and Rapid River drainages where heavy infestations persist.

Egg mass and pupal density samples from Douglas-fir foliage provide a reliable index as to next year's population level and resulting damage. The counts, respective collection areas, and damage predictions for 1966 are shown in the following table:

| <u>AREA</u> | <u>1965 DEFOLIATION</u> | | <u>1965 COLLECTIONS</u> | | <u>1966</u> | <u>TREND</u> |
|--------------|-------------------------|---------------|-------------------------|--------------|-----------------|--------------|
| | <u>PREDICTED</u> | <u>ACTUAL</u> | <u>EGG MASSES</u> | <u>PUPAL</u> | <u>EXPECTED</u> | |
| | (%) | (%) | (1000 SQ. INCHES) | DENSITY | DEFOLIATION | |
| Morse Creek | 90-100 | 75-90 | 12.7 | II | 90-100 | Inc. |
| Challis Cr. | 51-90 | 75-90 | 8.4 | I | 90-100 | Inc. |
| Morgan Cr. | - | - | 0.0 | - | 15 | Unknown |
| Big Hill Cr. | - | 75-90 | 14.8 | I | 75-90 | Unknown |
| Meyers Cove | - | - | 2.0 | - | 15 | Unknown |

(Challis N.F. continued)

Morse and Challis Creeks are the only areas that were sampled for egg masses in 1964 and 1965 consequently, they are the only areas for which trend predictions can be accurately made.

No overall decrease in budworm damage is expected to occur in 1966. Little change in the present infestation boundaries is anticipated; however, intensity of damage can be expected to remain the same as this year or possibly increase in certain areas. It is doubtful whether natural control factors will materially change the anticipated course of the infestation. Aggressive feeding has occurred in some areas for several years and tree mortality has been observed in reproduction and pole size Douglas-fir. At present the mortality takes on a mosaic pattern and some dead trees exist in the medium and heavily defoliated areas. If the infestation continues at its present pace, additional mortality can be expected.

FISHLAKE NATIONAL FOREST, 1965

Aerial surveys in 1964 picked up light spruce budworm infestations in South Creek, Birch Creek, along the south slope of Beaver River, in the south fork of North Creek and north of Elkhorn Guard Station. Total area of infestation then was estimated at 20,000 acres.

Aerial and ground surveys this year confirmed the infestations south of Beaver River and in the Elkhorn area. Infestations were spotted for the first time in Line Canyon, south fork of South Creek, Grindstone Flat, Levy Flat and north of Geyser Peak. Ground surveys reported scattered defoliation of subalpine fir in Big John's Flat. No defoliation was observed in Birch Creek or in the south fork of North Creek. The extent of defoliation as mapped from the air this year totaled 10,000 acres. Since all the defoliation was classed as light, there is little doubt that present budworm activity is more extensive than actually indicated. The main survey flight was not made until October 12, well after the optimum time for observing defoliation from the air. The heavy snowfall during early September undoubtedly removed most of the dead needles from the defoliated trees.

Spruce budworm feeding continued on Douglas-fir, Engelmann spruce and subalpine fir. Defoliation was observed from the ground in Elkhorn, south fork of Beaver River, Big John's Flat and Grindstone Flat. Overall defoliation by the budworm in all of these areas was classed as light.

Relatively accurate and consistent predictions can be made as to next year's population level and resulting damage by sampling the egg population the year before. Egg mass samples were taken from Douglas-fir foliage in five areas on the Forest. The egg mass counts and defoliation forecast for 1966 are shown below:

| Area | Number of New <u>Egg</u> Masses | | Percent Actual 1965 | Defoliation New Growth Predicted | | Trend |
|----------------|------------------------------------|------|---------------------------|-------------------------------------|-------|--------|
| | 1964 | 1965 | | 1965 | 1966 | |
| Elkhorn | 12.2 | 10.5 | 50-75 | 51-90 | 51-90 | Static |
| Grindstone | | 1.5 | 25-50 | | 15 | Static |
| So. Fk. Beaver | | 0.6 | 50-75 | | 15 | Static |
| Gun Sight | | 3.5 | | | 12-15 | Static |
| Big John's | | 2.6 | | | 15 | Static |

FISHLAKE NATIONAL FOREST, 1965 (continued)

Elkhorn was the only area sampled in 1964. Defoliation estimates derived from egg mass samples collected in 1964 proved to be relatively accurate. Defoliation counts were made this year in Elkhorne, Grindstone Flat and Beaver River, but not elsewhere. These defoliation estimates, expressed in percentage; pertain only to current growth. This may appear misleading to some but is necessary in making meaningful population damage correlations. Thus, it is possible that overall defoliation may not exceed 5 percent, even though 50 percent of the new growth has been removed.

The interpretation of current egg mass data forecasts light to moderate defoliation occurring in the Elkhorn area in 1966, and light defoliation elsewhere. Currently, no stands are threatened, nor is there any indication that they will be next year. Aerial and ground surveys will be intensified during 1966 at which time any significant changes in the anticipated course of the infestation will be noted.

PAYETTE NATIONAL FOREST, 1965

Populations of the spruce budworm have been in existence in varying locations on the forest for at least ten years. At the present time the largest and most serious infestation occurs primarily on wilderness lands along the main Salmon and Middle Fork of the Salmon River and their side drainages. Following is a table showing the last three years of spruce budworm infestation in the wilderness.

| | <u>Light</u> | <u>Medium</u> | <u>Heavy</u> | Total |
|------|--------------|---------------|--------------|---------|
| 1963 | 116,000 | 35,520 | 22,400 | 173,920 |
| 1964 | 42,880 | 59,840 | 13,280 | 116,000 |
| 1965 | 19,800 | 105,000 | 92,200 | 217,000 |

From the table it can be seen the bulk of the 1963 infestation occurred as light defoliation. Then, in 1964 due to unfavorable climatological factors coupled with predator and parasite activity, the infestation dropped off over 60,000 acres. From 1964 to 1965 the infestation took a sharp upward trend of over a 100,000 acres, and damage intensity shifted sharply to the medium and heavy defoliation categories. Aerial observers noted that the budworm spread upward from the Middle Fork of the Salmon River toward Chamberlain Basin into McCalla and Lodgepole Creeks at a rapid rate during 1965. Also, severe defoliation to Douglas-fir and true firs was noted in the Arctic Point area and Bear Creek. Light infestations of budworm were recorded throughout the length of Five Mile Creek and the lower two-thirds of Little Five Mile Creek.

Within the main body of the infestation, damage was most severe to reproduction and pole-size timber. In some locations mortality was observed, and showed up as scattered tree killing. The present mortality takes on a more or less shotgun pattern. In very few instances was mortality observed in mature and overmature age class trees even though they have been severely defoliated for a number of years. At the present time all indications point toward a continuation of moderate to heavy defoliation in the main Salmon and Middle Fork of the Salmon River portions of the infestation.

For the past three years light to moderate infestations of spruce budworm have been encountered from Yellow Pine east into the Quartz-Profile-Tamarack Creek areas, and north of Pilot Peak in Deering and Slide Creek. Fall aerial observations showed that both infestations had a marked reduction in defoliation. The Quartz, Profile, and Tamarack Creek areas showed only very light defoliation. The same can be said of defoliation in Deering and Slide Creek. These areas have shown decreasing defoliation tendencies for three years.

PAYETTE NATIONAL FOREST, 1965 (continued)

On the west side of the forest in Rapid River and its side drainages, light to moderate defoliation by the spruce budworm was noted in 1964. 1965 aerial surveys show only light defoliation and a reduction to approximately 9,500 acres of total infested type. Ground biological evaluations were not made in this area.

In summary, budworm infestations are expected to stay at a relatively low level in the three areas outside of the wilderness. Conversely, the wilderness infestation does not show any signs of slacking off. The infestation has shown increasing defoliation for three years, and extensions into previously uninfested stands have been recorded. Unless natural control factors reduce the budworms' biological potential, the infestation is expected to continue at epidemic levels.

SALMON NATIONAL FOREST, 1965

The overall extent of spruce budworm damage on the Forest apparently decreased considerably over that of last year. A summary of infested acreage by intensity of damage, as determined by aerial surveys, follows:

| Year | <u>Infestation Intensity</u> | | | Total |
|------|------------------------------|---------------|--------------|-----------|
| | <u>Light</u> | <u>Medium</u> | <u>Heavy</u> | |
| 1964 | 64,000 | 320,000 | 958,000 | 1,342,000 |
| 1965 | 296,500 | 77,400 | 336,000 | 709,900 |

Although the above shows that the infestation has been reduced by more than 600,000 acres, we suspect that the actual difference may be somewhat less. Budworm development was unusually slow this year and light feeding activity in some areas may have gone undetected during the earlier flights. In addition, much of the area within the boundaries of the 1964 control project was flown too late to permit full and accurate coverage. Early storms removed many of the defoliated needles and subsequent unfavorable flying weather forced us to end the survey; consequently, most of the northern half of the 1964 control area was not covered. Ground survey reports, however, showed light budworm activity in Hull Creek, Indian Creek, Spring Creek, and Long Tom Creek, and in other drainages north of the Salmon River. More than 260,000 acres of light defoliation were observed during late fall flights within the southern limits of the 1964 project boundary. This was substantiated by supplemental ground surveys.

Coverage elsewhere on the forest was relatively satisfactory. Practically all flights were made during good weather and at times when conditions for observing were optimum.

Based on previous experience, fairly accurate and consistent predictions can be made as to next year's population level and resulting damage, from data based on systematic samples of this year's egg masses and pupae. Samples of Douglas-fir foliage were taken from seven locations within the 1964 control area, and in ten areas elsewhere on the forest. 1965 egg mass counts and pupal density classes, the respective collection areas, and damage forecasts for 1966 are as follow:

SALMON NATIONAL FOREST, 1965 (continued)

| AREA | 1965 DEFOLIATION | | 1965 COLLECTIONS | | 1966 | TREND |
|---------------------|------------------|--------|------------------|---------|-------------|--------|
| | * | | EGG MASSES | PUPAL | EXPECTED | |
| | PREDICTED | ACTUAL | (1000 SQ. IN.) | DENSITY | DEFOLIATION | |
| | (%) | (%) | (No.) | (Class) | (%) | |
| <u>1964 Control</u> | | | | | | |
| Porphyry Cr. | 15-25 | 50-75 | 2.3 | I | 15 | Static |
| Moyer Cr. | 51-90 | 75-90 | 12.2 | II | 51-90 | Inc. |
| Dahlongega Cr. | 15-25 | 25-50 | 8.9 | I | 25-50 | Inc. |
| Blackbird Mine | 15-25 | 25-50 | 1.9 | I | 15 | Dec. |
| Carmen Cr. | 15-25 | 25-50 | 11.7 | I | 51-90 | Inc. |
| Rabbits Foot | 15 | 50-75 | 0.9 | I | 15 | Static |
| 4th of July Cr. | 15-25 | 25-50 | 1.5 | I | 15 | Dec. |
| <u>No Control</u> | | | | | | |
| McDevitt Cr. | 90-100 | 75-90 | 22.7 | II | 90-100 | Static |
| Williams Cr. | 51-90 | 75-90 | 9.7 | I | 51-90 | Static |
| Cow Cr. | 25-50 | 90-100 | 6.2 | III | 51-90 | Inc. |
| Agency Cr. | 51-90 | 90-100 | 23.0 | II | 90-100 | Inc. |
| Derian Cr. | 90-100 | 75-90 | 28.9 | II | 90-100 | Static |
| Little Dry Cr. | | 90-100 | 26.0 | II | 90-100 | |
| Timber Cr. | 90-100 | 90-100 | 50.3 | III | 90-100 | Inc. |
| Yellow Jacket | 25-50 | | 7.2 | | 25-50 | Inc. |
| Hayden Cr. | 51-90 | 75-90 | 20.2 | II | 90-100 | Inc. |

*Based on 1964 egg mass and pupae samples.

The predictions for 1965 defoliation based on 1964 egg mass counts and pupae classes, were generally conservative. On-the-ground defoliation measurements exceeded predicted defoliation except in two cases where the reverse was true. We do, however, have an idea as to the reason for this consistent difference, and plan to make the necessary adjustments as soon as practical.

SALMON NATIONAL FOREST, 1965 (continued)

Although overall intensity and extent of damage by the budworm decreased this year, continued heavy defoliation in most of the infestation areas can be expected next year. In those areas that have harbored heavy budworm populations, and have undergone repeated heavy defoliation, top kill of the overstory, top kill and limited mortality of the intermediate crown classes, and extensive kill of the understory can be expected. Douglas-fir will suffer the greatest damage. The impact of repeated defoliation on growth loss in these areas is being studied but has not as yet been determined.

Unless natural control factors exert pressure on budworm populations next year, a slight increase in intensity and extent of defoliation can be expected in the south half of the 1964 control area (Panther Creek drainage south of Cobalt) and in all of the drainages east of the North Fork of the Salmon, extending in a southeasterly direction to Carmen Creek. The rather rapid buildup of budworm populations in the 1964 spray area likely resulted from one, or a combination of the following factors: (1) residual budworm not killed by the spray, (2) relatively heavy residual populations left in the protective strips along the streams and in other critical areas not treated, and (3) reinfestation by moth flights from outside of the spray area. The full extent of the buildup, however, will not be known until next year.

SAWTOOTH NATIONAL FOREST, 1965

During the past decade spruce budworm populations on the Sawtooth National Forest have persisted in Douglas-fir and true fir stands within a ten-mile radius of Big Smoky Guard Station. Infestations in this area have shown a decided tendency to fluctuate in intensity in high and low periods averaging two to three years apart. Entomological observations of the infestation show that the fluctuations have probably been brought about by cyclical buildups of predators and parasites. Also, adverse weather conditions on two occasions have drastically reduced population levels. In these instances torrential rains and hailstorms drowned or battered to death considerable numbers of adult moths before they had a chance to oviposit. As a consequence the preceding year's populations were reduced to low levels.

Starting in 1961 budworm populations showed a steady increase until 1963. From 1963 to 1964 there was a slight reduction in trees affected. From 1964 to 1965 a somewhat drastic reduction in total acreage of affected Douglas-fir and true fir type was observed. Aerial observations in 1965 showed that slightly over 9,000 acres were defoliated. This represents a six-fold decrease in total area infested from 1964 to 1965. Following is a table summarizing the last five years budworm activity on the forest:

| Year | Light | Medium | Heavy | Total |
|------|--------|--------|--------|--------|
| 1961 | 5,000 | 3,000 | 5,000 | 13,000 |
| 1962 | 4,000 | 10,000 | 27,000 | 41,000 |
| 1963 | 14,720 | 25,440 | 20,000 | 60,160 |
| 1964 | 32,000 | 21,000 | 1,000 | 54,000 |
| 1965 | - | 9,000 | - | 9,000 |

From egg mass surveys made during 1965 it is predicted that approximately 60% of the area will have defoliation ranging from 25 to 50 percent; 20% will be defoliated from 51 to 90 percent; the remaining 20% is expected to be defoliated from 90-100 percent. These figures represent the defoliation that is expected to occur on next year's new growth. Specific predictions for individual areas are given in the following table:

SAWTOOTH NATIONAL FOREST, 1965 (continued)

| Area | 1965 Defoliation | | 1965 Collections | | Expected | Trend |
|------------------|------------------|--------|-----------------------------|------------------|---------------------|------------|
| | Predicted | Actual | Egg Masses (1000 sq.in.) | Pupal Density | Defoliation 1966 | |
| | (%) | (%) | (No.) | (Class) | (%) | |
| Fleck Summit So. | 51-90 | 90 | 20.2 | IV | 90-100 | Increasing |
| Fleck Summit No. | 51-90 | 90 | 12.7 | IV | 51-90 | Increasing |
| Bounds Creek | 51-90 | 75-90 | 5.8 | III | 25-50 | Static |
| Little Smoky Cr. | 15-25 | - | 6.0 | - | 25-50 | Static |
| Couch Summit | 51-90 | 75-90 | 7.3 | III | 25-50 | Static |

In summary the Sawtooth infestation has undergone a drastic reduction in total acreage defoliated during 1965. Population reductions were probably brought about by natural biological control agents and adverse climatological factors that were unfavorable for optimum budworm development. At the present time, however, there is sufficient residual populations present that will cause defoliation during next year.

TARGHEE NATIONAL FOREST, 1965

Since 1956, the time when the first spruce budworm infestations were reported on the Forest, infestations increased in severity and extent until 1963, when more than 200,000 infested acres were controlled by aerial spraying. This successful spray operation resulted in a significant reduction of infested acreage in 1964 and little change in the extent or intensity of infestation was noted this year. The extent of the present infestation by major defoliation classes, as determined by aerial surveys is shown below.

| Division | Defoliation Intensity | | | Total |
|----------|-----------------------|--------|--------------|--------|
| | <u>Light</u> | Medium | <u>Heavy</u> | |
| East | 9,000 | 4,200 | 3,800 | 17,000 |
| West | 37,100 | 38,400 | 5,400 | 80,900 |
| Total | 46,100 | 42,600 | 9,200 | 97,900 |

Less than ten percent of the total area received heavy defoliation this year. This area, east of Humphrey, was also heavily defoliated last year. Defoliation in other areas was light to moderate.

Most of the major infestation centers showed no appreciable change in size or intensity of damage from that reported in 1965. One exception, however, was the finding of visible defoliation on approximately 18,000 acres between the West Fork of Indian Creek and Pleasant Valley. Another exception was 2,400 acres of light defoliation in Douglas-fir east of Swan Valley. The infestation on the northeast side of Sawtelle Peak that was first reported in 1964 and the two infestations bordering Sheridan Reservoir that were detected earlier, were not visible from the air this year.

Normally, accurate and consistent predictions regarding the following year's population levels and resulting damage can be made from data based on systematic sampling of a current year's egg masses and pupae. Collections from Douglas-fir foliage were made in ten areas on the Forest this year. Egg mass counts and pupal density classes for 1965, respective collection points, and damage predictions for 1966 follow:

TARGHEE NATIONAL FOREST, 1965 (continued)

| Area | 1965 Defoliation | | 1965 Collections | | 1966 Expected Defoliation (%) | Trend |
|-------------------|------------------------|---------------|--------------------------------------|-----------------------------|--|--------|
| | Pre- dicted* (%) | Actual (%) | Egg Masses (1000 sq.in.) (No.) | Pupal Density (Class) | | |
| Dry Creek | 15 | 50-75 | 6.0 | I | 25-50 | Dec. |
| Targhee Creek | 15 | 25 | 0.0 | I | 25 | Static |
| Taylor Creek | 15 | 25-40 | 0.0 | I | 25 | Static |
| Twin Creek | 15 | 25 | 0.0 | I | 25 | Static |
| W. Camas Creek | 15 | 25 | 0.2 | I | 25 | Static |
| Rattlesnake Creek | 15 | 50-75 | 3.1 | I | 25 | Dec. |
| Gillian Creek | 15 | 50-75 | 0.7 | III | 25-50 | Dec. |
| Snider Creek | 15 | 50-75 | 0.0 | I | 25 | Dec. |
| Howard Creek | 15 | 25-50 | 0.0 | II | 25 | Dec. |
| Willow Creek | 15 | 25 | 0.0 | I | 25 | Dec. |

*Based on 1964 egg mass and pupal density samples.

As noted above, damage predictions for 1965 were conservative. On-the-ground defoliation measurements consistently exceeded predicted defoliation. Adjustments have been made in sampling and interpretative techniques that should result in closer predictions in the future. A possible reason for the differences that occurred this year was that two other defoliators, a budmoth, possibly Zeiraphera sp. and the black-headed budworm, Acleris variana (Fern.), were found associated with the spruce budworm in some areas, particularly the 1963 Sevin spray area. Feeding damage from these insects was not distinguishable from that of the spruce budworm; consequently, next year's defoliation may exceed the level predicted for the spruce budworm. At this time we have no method for predicting future damage by these insects, either singly, together, or in combination with the spruce budworm.

Spruce budworm egg mass and pupal density counts indicate a receding trend for budworm populations in practically all of the infestation areas next year. The only exception to this may be in Dry Creek where egg populations were recorded as moderately high.

Spider mite infestations of Douglas-fir in the 1963 spray areas are generally low. The areas with the highest population levels this year were Twin, Dry and Targhee Creeks. These areas, however, contained only low to moderately high populations. No change in spider mite activity is expected in 1966.